University of Washington
College of Engineering
Department of Electrical Engineering

MT. BAKER, WASHINGTON
COLEMAN GLACIER SURVEY

DESCRIPTION AND COORDINATES OF PHOTOGRAMMETRIC CONTROL STATIONS

Prepared by

A. E. Harrison

Technical Report No. 181

December 10, 1974

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MT. BAKER, WASHINGTON
COLEMAN GLACIER SURVEY

DESCRIPTION AND COORDINATES OF PHOTOGRAMMETRIC CONTROL STATIONS

by

A. E. Harrison

A survey of the Coleman Glacier on the northwest slope of Mt. Baker was initiated in 1949 by Kermit Bengtson[1] with the aid of Arthur Johnson and Fred M. Veatch of the United States Geological Survey in Tacoma, Washington. This project led to the discovery in 1950 that the Coleman Glacier front was advancing over the barren ground, although residual stagnant ice remained in the canyon bottom some distance below the active front. The last of this relict ice melted in 1955. Kermit Bengtson established a number of monumented survey stations and several temporary stations for measuring the position of the glacier front and surface profiles at the 4700 to 6000 foot levels. Most of these stations were on a relatively flat area known as the "Bench," shown on a copy of Bengtson's[1] map of the vicinity on page 10.

Bengtson was recalled to active duty in the U.S. Navy in 1951 and the work at Mt. Baker was continued by A. E. Harrison in 1952, again with the help of Arthur Johnson and Fred Veatch. Terrestrial photogrammetry was adopted in 1954 to replace the azimuth and stadia methods used previously. By this time it had become apparent that the early survey stations were inadequate, (most of them were already covered by the advancing ice). New stations were established by Kermit Bengtson in 1954 and 1955, and by

A. E. Harrison in 1953, 1957, 1958, 1959, 1962 and 1969. These stations were triangulated by Kermit Bengtson in 1954 and 1955, Burt Ingalls in 1959, and Ken Gregory in 1963. Duane Hartman measured two Geodimeter baselines for the survey in 1963.

In the summer of 1969, a few months after the publication of Technical Report No. 129,[2] the ice advanced to within 80 feet of Station T, the photogrammetric control target on the Bench. The possibility of losing a principal control station emphasized the need for additional stations, and stations LUNCH, BEDROCK and ROADWAY were added in 1969. The horizontal coordinates for the new stations and for station P-4 were obtained in 1971 by Dave Collins and James Hall. The elevation for Station LUNCH was surveyed by Dave Lee in 1970 and the elevations for Stations BEDROCK, ROADWAY and P-4 were surveyed by A. E. Harrison in 1974. The horizontal coordinates for three reference stations for Station P-3 were determined by A. E. Harrison later in the same year.

The results of these surveyes have been used as control for maps of the Coleman Glacier in 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1964 and 1965, plotted by Professor Dr. Ing. Walther Hoffman in Germany. 1967 and 1969 photogrammetry is available but has not yet been mapped.

The work can be considered a third-order survey. The points have not been tied to the U.S.G.S. Mt. Baker topographic sheet and represent an independent coordinate system. Azimuths are measured from an assumed north reference, which differs from Bengtson's corrected magnetic north by 1.25° and from the topographic sheet

by approximately the same angle. Elevations are based on Bengtson's 1955 vertical angles and an elevation of 7128.0 feet for Station HELIOTROPE, which corresponds to the elevation of U.S.G.S. Station 47-76B. Subsequent elevations have been adjusted to 1955, since it was not considered desirable to change the datum for the terrestrial photogrammetric maps.

Revised horizontal coordinates have been used for Station HELIOTROPE and the elevation of Station P-3 has been increased by 1.9 feet to bring it into closer agreement with the other elevations obtained in 1970 and 1974.

Photographic stations are also included to make the record complete. Station P-3 is the only photographic station which is part of the control net. Station P-4 is monumented but is not useful in the net because it is in unstable fill and has already shifted an unknown amount, and leaned about 8 degrees. Coordinates for Bengtson's 1949 stations were estimated to the nearest foot by comparison with the coordinates of Stations A and L. Elevations were adjusted by subtracting 19 feet from Bengtson's 1949 barometric elevations to bring Station A in agreement with the 1955 datum.

Results are summarized in a table, a map of the entire area, a map of the reference markers for Station P-3, and a map of the vicinity known as the Bench, with added data for the ice position in 1952, 1953, 1955 and 1960. Descriptions and data for each station are given on individual sheets.

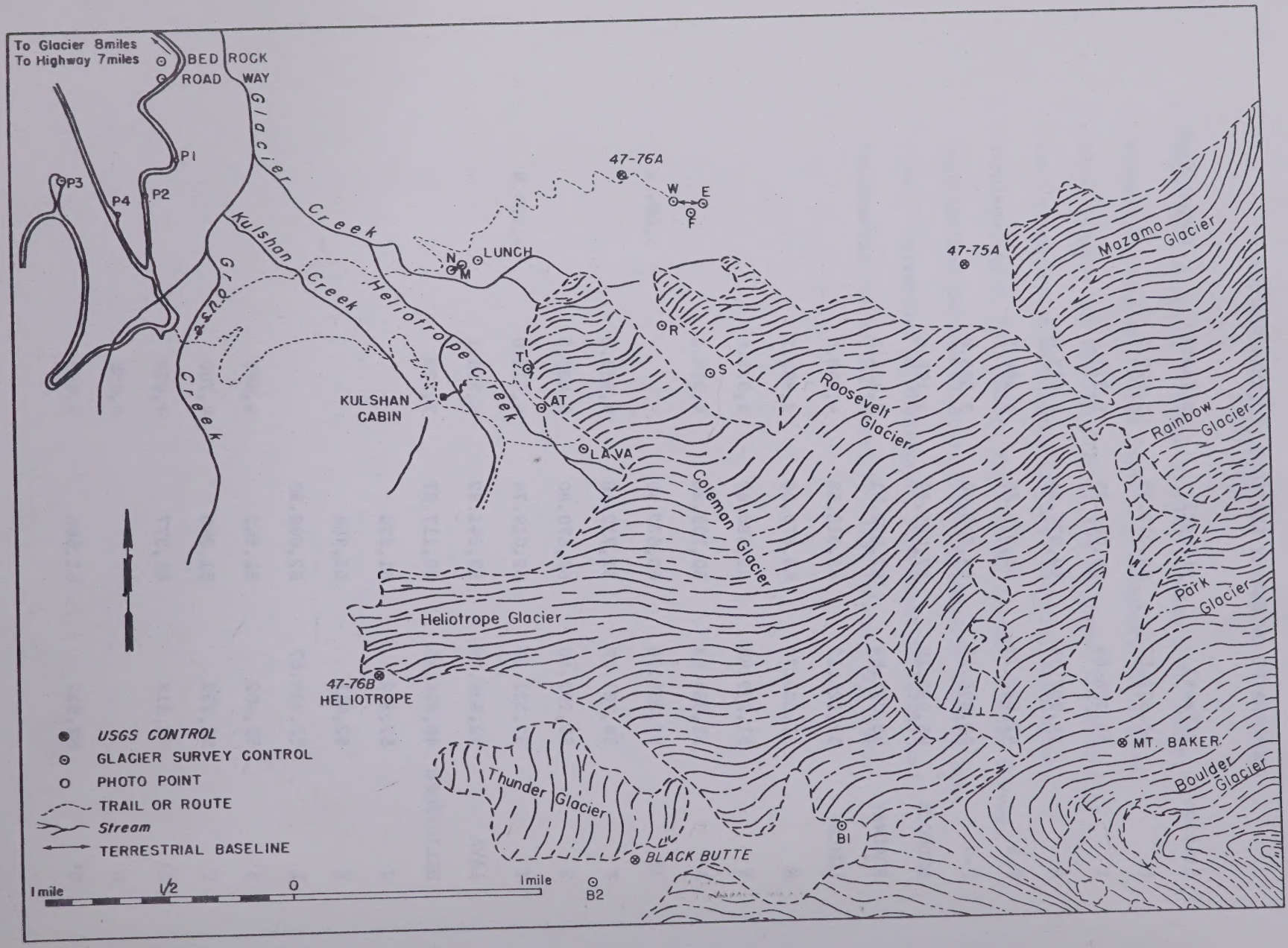
REFERENCES

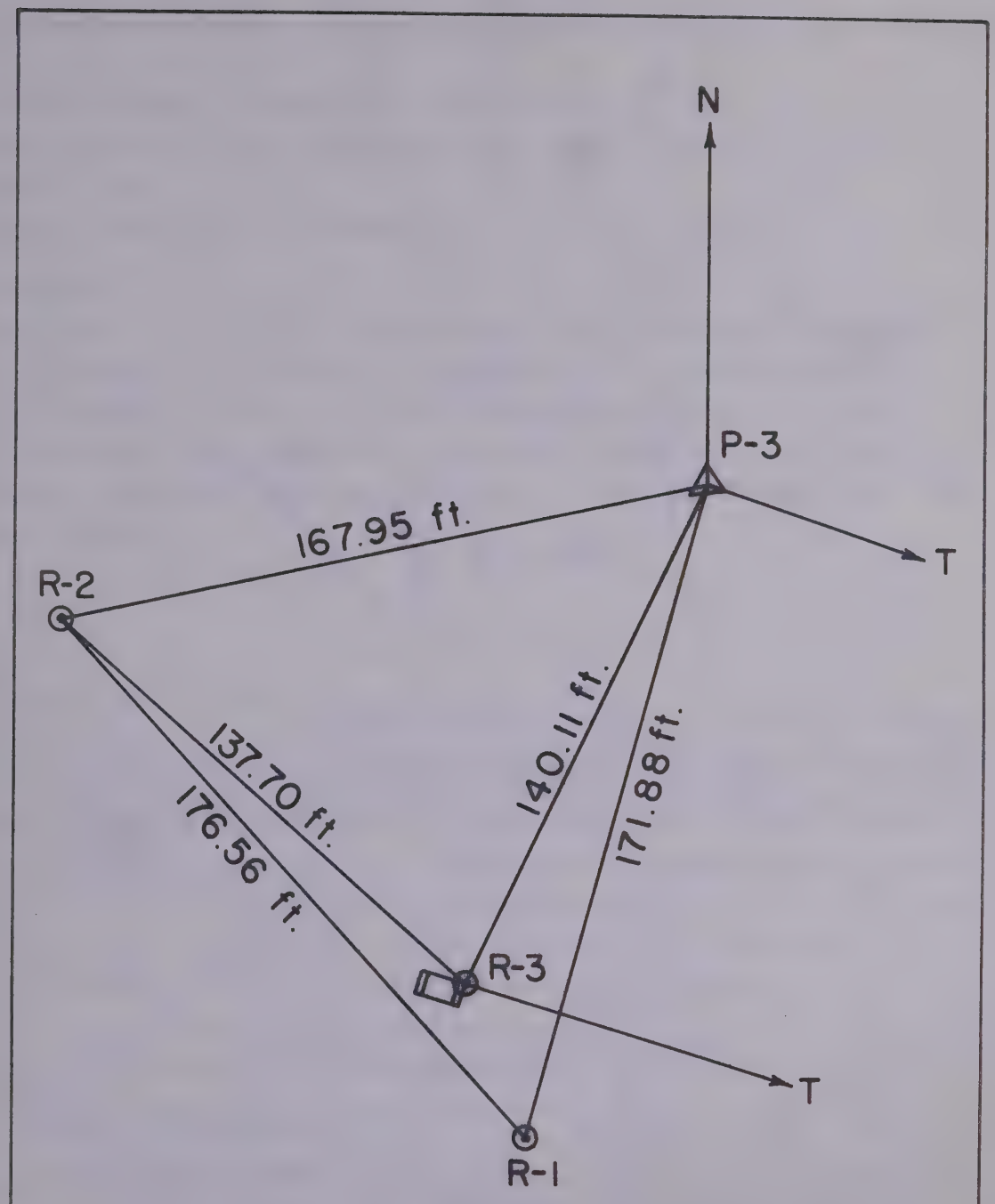
1. Bengtson, Kermit B. "Coleman Glacier Studies - Mt. Baker," Western Washington College Report, Bellingham, Washington, 1951. Copies are also on file in the Northwest Collection of the University of Washington Library, Seattle, Washington.

2. Harrison, A. E. "Mt. Baker, Washington, Coleman Glacier Survey, Descriptions and Coordinates of Photogrammetric Control Stations," University of Washington, Department of Electrical Engineering, Technical Report No. 129, February 21, 1969.

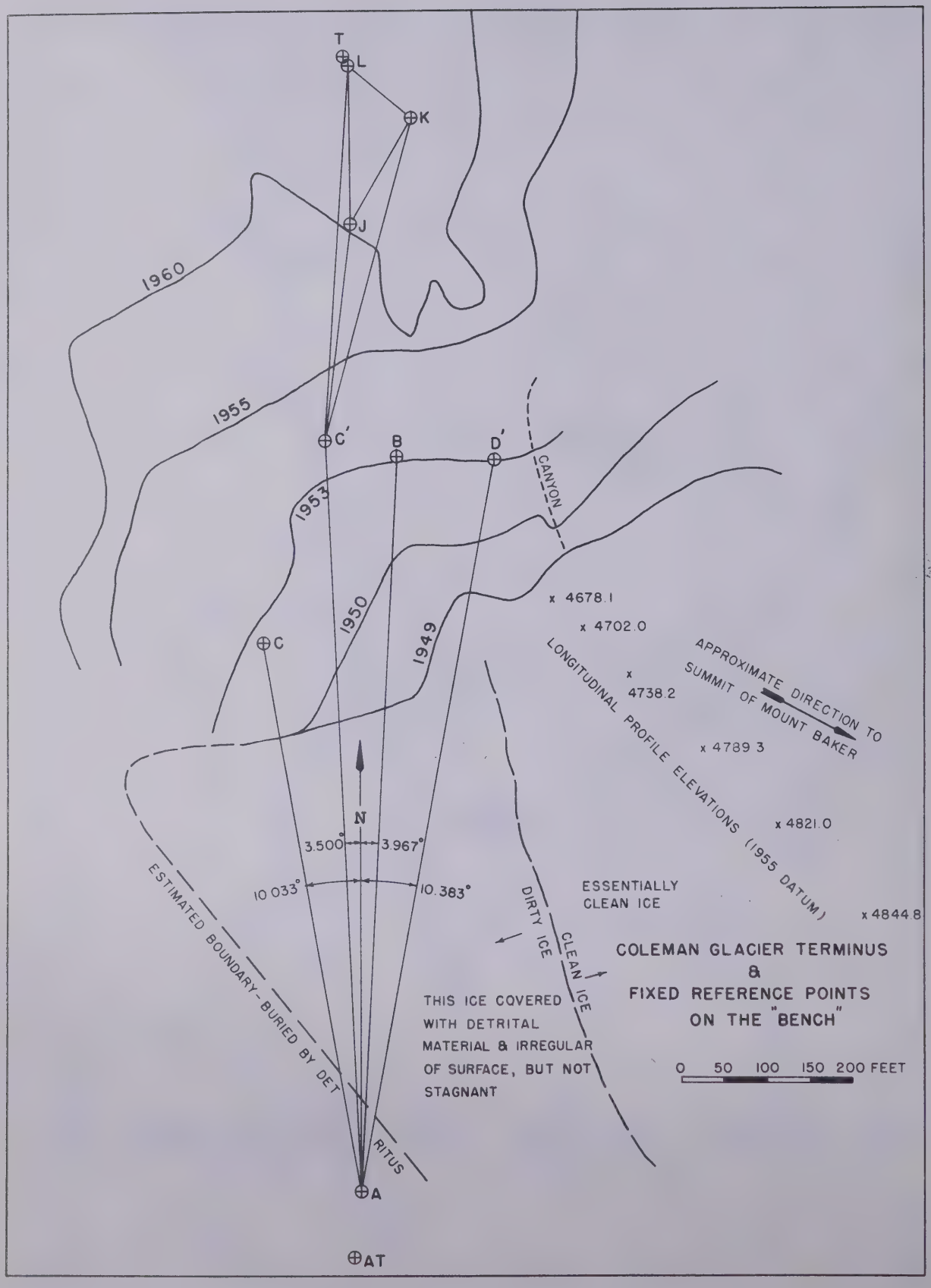
COORDINATES OF SURVEY STATIONS, COLEMAN GLACIER

Station	x(feet)	y(feet)	z(feet)	Target(feet
E	55,572.67	64,073.79	5,622.7	
F	55,328.64	64,065.75	5,577.9	
W	54,987.74	64,377.36	5,617.4	
P-3	42,633.11	65,325.86	4,164.5	
P-4	44,696.15	64,903.00	3,665.4	
BEDROCK	45,080.15	67,455.59	3,196.6	
ROADWAY	45,027.64	67,079.41	3,151.6	
LUNCH	52,126.12	63,918.53	4,368.0	
M	51,503.70	63,670.06	3,960.2	
N	51,279.40	63,586.67	3,935.6	
A	52,384.63	60,709.88	4,914.8	
AT	52,369.26	60,632.40		5,004.1
R	54,761.09	61,712.16	4,930.8	
S	55,293.50	60,670.80	5,432.5	
T	52,331.20	62,019.74	4,618.0	4,620.4
LAVA	52,936.28	59,541.82	5,359.1	
HELIOTROPE	48,826.65	55,117.87	7,128	
J	52,342	61,828		
K	52,411	61,954		
L	52,334.67	62,008.90		
B	52,402	61,562	4,693	
C	52,252	61,340	4,700	
C'	52,318	61,577	4,698	
D			6,050	
D'	52,512	61,566	4,683	


To Glacier 8miles
To Highway 7miles
BED ROCK ROAD WAY
P1
P2
P3
P4
Glacier Creek
Kulshan Creek
Heliotrope Creek
Grasp Creek
47-76A
W
E
F
N
M
LUNCH
R
S
T
AT
LAVA
KULSHAN CABIN
47-75A
Mazama Glacier
Roosevelt Glacier
Rainbow Glacier
Coleman Glacier
Park Glacier
Heliotrope Glacier
47-76B
HELIOTROPE
MT. BAKER
Boulder Glacier
Thunder Glacier
BLACK BUTTE
B1
B2
USGS CONTROL
GLACIER SURVEY CONTROL
PHOTO POINT
TRAIL OR ROUTE
Stream
TERRESTRIAL BASELINE
1 mile
1/2
0
1 mile



REFERENCE STATIONS FOR STATION P-3


T
L
K
J
1960
1955
C'
B
D'
CANYON
1953
1950
1949
C
x 4678.1
x 4702.0
x 4738.2
x 4789.3
x 4821.0
x 4844.8
APPROXIMATE DIRECTION TO SUMMIT OF MOUNT BAKER
LONGITUDINAL PROFILE ELEVATIONS (1955 DATUM)
N
3.500°
3.967°
10.033°
10.383°
ESTIMATED BOUNDARY - BURIED BY DET
RITUS
A
AT
ESSENTIALLY CLEAN ICE
DIRTY ICE
CLEAN ICE
THIS ICE COVERED WITH DETRITAL MATERIAL & IRREGULAR OF SURFACE, BUT NOT STAGNANT
COLEMAN GLACIER TERMINUS
&
FIXED REFERENCE POINTS
ON THE "BENCH"
0 50 100 150 200 FEET

COLEMAN GLACIER SURVEY

Station E

Station Monument: Aluminum disk, labeled UWCE E

Reference Points: Three brass studs for bolting tripod legs

Target: None

Target Intersection Above Monument:

Description:

The eastern end of a 659.01 foot baseline on Bastile Ridge for terrestrial photogrammetry of the Coleman and Roosevelt Glaciers, established by Kermit Bengtson in 1955. The point is some distance below the top of Bastile Ridge, across (east) of a gully which usually has a very small stream. Three brass studs for bolting tripod legs are embedded in the rock with Rawl-Plugs.

Tentative Coordinates:

x = 55,572.67 feet y = 64,073.79 feet Elevation = 5,622.7 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F	268.11306	244.16	Yes
W	297.42861	659.01	Yes
P-3	275.52694	13,000.00	No
P-4	274.35971	10,908.08	No
BEDROCK	287.86443	11,024.04	No
ROADWAY	285.90899	10,965.01	No
LUNCH	272.57931	3,450.05	No
M	264.33361	4,088.95	No
N	263.52694	4,320.82	No
A	223.46250	4,634.60	No
AT	222.94889	4,701.60	Yes
R			Yes
S			Yes
T	237.63833	3,837.48	Yes
LAVA	210.18806	5,243.02	Yes
HELIOTROPE	216.98878	11,212.37	Yes

COLEMAN GLACIER SURVEY

Station F

Station Monument: Aluminum disk, labeled UWCE F

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

This point was established in 1959 by A. E. Harrison to give a baseline with a better angle for photographing the Roosevelt Glacier. It is an aluminum monument embedded in bedrock on a prominent knob between stations E and W. The baseline is too short and has not been used. The point would be excellent as control for vertical photogrammetry.

Tentative Coordinates:

x = feet	y = feet	Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	88.11306	244.16	Yes
F			
W	312.42972	461.86	Yes
P-3			Yes
P-4			
BEDROCK			No
ROADWAY			No
LUNCH			No
M			No
N			No
A			No
AT			Yes
R			Yes
S			Yes
T			Yes
LAVA			Yes
HELIOTROPE			Yes

COLEMAN GLACIER SURVEY

Station W

Station Monument: Aluminum disk, labeled UWCE W

Reference Points: Three brass studs for bolting tripod legs

Target: None

Target Intersection Above Monument:

Description:

The western end of a 659.01 foot baseline on Bastile Ridge for terrestrial photogrammetry of the Coleman and Roosevelt Glaciers, established by Kermit Bengston in 1955. The point is slightly below the top of Bastile Ridge. Three brass studs for bolting tripod legs are embedded in the rock with Rawl-Plugs. The station is surrounded by a wooden catwalk to facilitate measurements.

Tentative Coordinates:

x = 54,987.74 feet	y = 64,377.36 feet	Elevation = 5,617.4 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	117.42861	659.01	Yes
F	132.42972	461.86	Yes
W			
P-3	274.39028	12,390.99	Yes
P-4	272.92382	10,305.00	No
BEDROCK	287.25971	10,374.77	No
ROADWAY	285.17831	10,320.11	No
LUNCH	279.10923	2,898.17	No
M	258.52417	3,555.11	No
N	257.96361	3,791.70	No
A	215.36639	4,497.40	No
AT	214.96139	4,569.59	Yes
R			Yes
S			Yes
T	228.41167	3,551.84	Yes
LAVA	202.98889	5,252.71	Yes
HELIOTROPE	213.63905	11,121.92	Yes

COLEMAN GLACIER SURVEY

Station P-3

Station Monument: Aluminum disk, labeled UWCE P-3

Reference Points: R1, R2, R3

Target: None

Target Intersection Above Monument:

Description:

A photographic station established August 6, 1953 by A. E. Harrison on the stub road above the beginning of the Mt. Baker Trail. It was identified in 1962 with an aluminum monument embedded in a concrete post one foot below the surface, protected by a sewer tile. Its location has been marked by Forest Service signs since 1965. This station is also a principal triangulation point for the control survey.

Tentative Coordinates:

x = 42,633.11 feet	y = 65,325.86 feet	Elevation = 4,164.5 feet	
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	95.52694	13,000.00	No
F			Yes
W	94.39028	12,390.99	Yes
P-3			
P-4	101.58344	2,105.93	No
BEDROCK	48.96600	3,244.03	Trees
ROADWAY	53.78413	2,967.95	Yes
LUNCH	98.43263	9,596.76	Yes
M	100.57333	9,023.80	No
N	101.37333	8,819.47	Yes
A	115.33111	10,788.86	No
AT	115.73722	10,808.39	No
R			Yes
S			Yes
T	108.82444	10,246.14	Yes
LAVA	119.30917	11,815.69	Yes
HELIOTROPE	148.75337	11,939.97	Yes

COLEMAN GLACIER SURVEY

Reference R-1

Station Monument: **Aluminum disk, labeled UWCE R-1**

Reference Points:

Target: **None**

Target Intersection Above Monument:

Description:

A reference station for Station P-3. It is an aluminum monument embedded in a piece of tubing driven into an old stump on the hillside east of the outhouse by David Collins in 1971.

Tentative Coordinates:

x = 42,589.59 feet y = 65,159.58 feet Elevation = feet			
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3	14.6683°	171.88	Yes
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Reference R-2

Station Monument: Aluminum disk, labeled UWCE R-2

Reference Points:

Target: None

Target Intersection Above Monument:

Description:

A reference station for Station P-3. It is an aluminum monument embedded in a piece of tubing driven into an old stump west of the outhouse on the hillside near and slightly east of an old logging road. It was installed by David Collins in 1971.

Tentative Coordinates:

x = 42,469.29 feet y = 65,288.82 feet Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3	77.2600°	167.95	Yes
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Reference R-3

Station Monument: None

Reference Points: Outhouse foundation

Target: None

Target Intersection Above Monument:

Description:

A reference station for Station P-3 established by A.E. Harrison in October, 1974. It is the northeast corner of the concrete foundation for the outhouse. There is no monument.

Tentative Coordinates:

x = 42,573.65 feet y = 65,198.99 feet Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3	25.1092°	140.11	Yes
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station P-4

Station Monument: Aluminum disk, labeled UWCE P-4

Reference Points: Stump 12.17 feet downslope from monument

Target: None

Target Intersection Above Monument:

Description:

A photographic station established June 15, 1958 by A. E. Harrison after the logging road to Lookout Mtn. was opened. It is located at the edge of a wide turnout in the road about one quarter of a mile from the junction, 12.17 feet back from the near side of a stump. It was identified in 1962 with an aluminum disk embedded in a concrete post one foot below the surface, protected by a sewer tile. Its location was marked by a Forest Service sign in 1964, which should be removed, since the post aggravates snow creep which has moved the marker an unknown amount and tilted it about 8 degrees from vertical.

Tentative Coordinates:

x = 44,696.15 feet	y = 64,903.00 feet	Elevation = 3,665.4 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	94.35971	10,908.08	No
F			
W	92.92382	10,305.00	No
P-3	281.58344	2,105.93	No
P-4			
BEDROCK	8.55516	2,581.31	No
ROADWAY	8.66019	2,201.51	Tree
LUNCH	97.54772	7,494.91	Yes
M	100.26576	6,918.30	No
N	101.30725	6,713.56	No
A	118.60703	8,757.57	No
AT	119.09887	8,781.49	No
R			Yes
S			Yes
T	110.68828	8,161.32	Yes
LAVA	123.04877	9,830.67	Yes
HELIOTROPE	157.11441	10,621.20	Yes

COLEMAN GLACIER SURVEY

Station BEDROCK

Station Monument: Aluminum disk, labeled UWCE BEDROCK

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A basic control point established in 1969 to strengthen the control net in the event Station T should be covered by advancing ice. It is located on an outcrop of bedrock above the quarry, southeast and below the top of the hill. By 1971, new forest was beginning to block intervisibility with other targets.

Tentative Coordinates:

x = 45,080.15 feet y = 67,455.59 feet Elevation = 3,196.6 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	107.86443	11,024.04	No
F			No
W	107.25971	10,374.77	No
P-3	228.96600	3,244.03	Trees
P-4	188.55516	2,581.31	No
BEDROCK			
ROADWAY	187.94643	379.83	No
LUNCH	116.65654	7,883.94	No
M	120.51172	7,456.02	No
N	121.96807	7,307.48	No
A	132.72257	9,942.84	No
AT	133.10906	9,984.34	No
R			
S			
T	126.85757	9,062.35	Yes
LAVA	135.20942	11,151.08	Yes
HELIOTROPE	163.10844	12,894.01	Yes

COLEMAN GLACIER SURVEY

Station ROADWAY

Station Monument: Aluminum disk, labeled UWCE ROADWAY

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A basic control point established in 1969 to strengthen the control net in the event Station T should be covered by advancing ice. It is located on a bedrock outcrop on the north side of the Glacier Creek Road, beyond a closed logging road spur, below Station BEDROCK.

Tentative Coordinates:

x = 45,027.64 feet	y = 67,079.41 feet	Elevation = 3,151.6 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	105.90899	10,965.01	No
F			No
W	105.17831	10,320.11	No
P-3	233.78413	2,967.95	Yes
P-4	188.66019	2,201.51	Trees
BEDROCK	7.94643	379.83	No
ROADWAY			
LUNCH	114.00292	7,770.43	No
M	117.76476	7,318.68	No
N	119.19127	7,161.27	No
A	130.88534	9,731.20	No
AT	131.28784	9,770.53	No
R			
S			
T	124.71296	8,884.95	Trees
LAVA	133.62390	10,925.28	Yes
HELIOTROPE	162.38004	12,550.34	Trees

COLEMAN GLACIER SURVEY

Station LUNCH

Station Monument: Aluminum disk, labeled UWCE LUNCH

Reference Points: Three brass studs for bolting tripod legs.

Target: None

Target Intersection Above Monument:

Description:

A basic control point established in 1969 to strengthen the control net in the event Station T became covered by advancing ice. It is located on the cliffs above baseline MN, behind (north) and below the observation point known as Luncheon Point.

Tentative Coordinates:

x = 52,126.12 feet	y = 63,918.53 feet	Elevation = 4,368.0 feet	
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	92.57931	3,450.05	No
F			No
W	99.10923	2,898.17	No
P-3	278.43263	9,596.76	Yes
P-4	277.54772	7,494.91	Yes
BEDROCK	296.65654	7,883.94	No
ROADWAY	294.00292	7,770.43	No
LUNCH			
M	248.23812	670.18	Yes
N	248.59800	909.43	Yes
A	175.39382	3,219.05	No
AT	175.76841	3,295.11	
R			Yes
S			Yes
T	173.83563	1,909.83	Yes
LAVA	169.51285	4,451.06	Yes
HELIOTROPE	200.55161	9,398.84	Yes

COLEMAN GLACIER SURVEY

Station M

Station Monument: Aluminum disk, labeled UWCE M

Reference Points: Three brass studs for bolting tripod legs

Target: None

Target Intersection Above Monument:

Description:

The eastern end of a 239.30 foot baseline established by A. E. Harrison in 1958 for terrestrial photogrammetry of the terminus of the Coleman Glacier after it advanced out of sight from the EW baseline on Bastile Ridge in 1957. The point is identified by an aluminum monument embedded in a five foot boulder. Three brass studs for bolting tripod legs are embedded in the boulder with Rawl-Plugs. The station is surrounded by a wooden catwalk to facilitate measurements.

Tentative Coordinates:

x = 51,503.70 feet	y = 63,670.06 feet	Elevation = 3,960.2 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	84.33361	4,088.95	No
F			No
W	78.52417	3,555.11	No
P-3	280.57333	9,023.80	No
P-4	280.26576	6,918.30	No
BEDROCK	300.51172	7,456.02	No
ROADWAY	297.76476	7,318.68	No
LUNCH	68.23812	670.18	Yes
M			
N	249.60583	239.30	Yes
A	163.42722	3,088.48	No
AT	164.09556	3,158.57	No
R			Yes
S			Yes
T	153.37000	1,846.16	Yes
LAVA	160.86222	4,369.74	No
HELIOTROPE	197.38143	8,961.39	Yes

COLEMAN GLACIER SURVEY

Station N

Station Monument: Aluminum disk, labeled UWCE N

Reference Points: Three brass tripod-leg studs, six foot boulder

Target: None

Target Intersection Above Monument:

Description:

The western end of a 239.30 foot baseline established by A. E. Harrison in 1958 for terrestrial photogrammetry of the terminus of the Coleman Glacier. The point is identified by an aluminum monument embedded in bedrock near a six-foot, perched boulder. Three brass studs for bolting tripod legs are embedded in the rock with Rawl-Plugs.

Tentative Coordinates:

x = 51,279.40 feet	y = 63,586.67 feet	Elevation = 3,935.6 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	83.52694	4,320.82	No
F			No
W	77.96361	3,791.70	No
P-3	281.37333	8,819.47	Yes
P-4	281.30725	6,713.56	No
BEDROCK	301.96807	7,307.48	No
ROADWAY	299.19127	7,161.27	No
LUNCH	68.59800	909.43	Yes
M	69.60583	239.30	Yes
N			
A	158.98389	3,081.79	No
AT	159.75056	3,148.89	No
R			Yes
S			Yes
T	146.12861	1,887.21	Yes
LAVA	157.72472	4,371.05	No
HELIOTROPE	196.15217	8,816.83	Yes

COLEMAN GLACIER SURVEY

Station A

Station Monument: Bronze disk, labeled 1B49

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A control point established in 1949 by Kermit Bengtson for a cross profile. It is a bronze monument, similar to the U.S.G.S. monuments, embedded in a bedrock knob between the cliff and the Coleman Glacier, below Heliotrope Camp and Station AT. This point has been superseded as a control point by Station AT.

Tentative Coordinates:

x = 52,384.63 feet	y = 60,709.88 feet	Elevation = 4,914.8 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	43.46250	4,634.60	No
F			No
W	35.36639	4,497.40	No
P-3	295.33111	10,788.86	No
P-4	298.60703	8,757.57	No
BEDROCK	312.72257	9,942.84	No
ROADWAY	310.88534	9,731.20	No
LUNCH	355.39382	3,219.05	No
M	343.42722	3,088.48	No
N	338.98389	3,081.79	No
A			
AT	191.22028	78.99	Yes
R			No
S			No
T	357.66417	1,310.95	No
LAVA	154.71972	1,291.78	No
HELIOTROPE	212.46702	6,627.96	No

COLEMAN GLACIER SURVEY

Station AT

Station Monument: None

Reference Points: None

Target: Three-foot, circular white wooden target with black X.

Target Intersection Above Monument:

Description:

A photogrammetric target installed in 1957 by A. E. Harrison after Station A was hidden by the increased thickness of the Coleman Glacier. It is a three-foot wooden target bolted to a tree above and about five feet behind the top of the cliff below Heliotrope Camp.

Tentative Coordinates:

x = 52,369.26 feet	y = 60,632.40 feet	Elevation = 5,004.1 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	42.94889	4,701.60	Yes
F			Yes
W	34.96139	4,569.59	Yes
P-3	295.73722	10,808.39	No
P-4	299.09887	8,781.49	No
BEDROCK	313.10906	9,984.34	No
ROADWAY	311.28784	9,770.53	No
LUNCH	355.76841	3,295.11	
M	344.09556	3,158.57	No
N	339.75056	3,148.89	No
A	11.22028	78.99	Yes
AT			
R			No
S			Yes
T	358.42861	1,387.86	No
LAVA	152.52889	1,229.18	No
HELIOTROPE	212.71725	6,554.40	No

COLEMAN GLACIER SURVEY

Station R

Station Monument: None

Reference Points: None

Target: Missing since 1970

Target Intersection Above Monument:

Description:

A photogrammetric control target installed by A. E. Harrison in 1957 between the tongues of the Coleman and Roosevelt Glaciers. It was identified by a small drill hole in bedrock. The target has been missing since 1970.

Tentative Coordinates:

x = 54,761.09 feet y = 61,712.16 feet Elevation = 4,930.8 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			Yes
F			Yes
W			Yes
P-3			Yes
P-4			Yes
BEDROCK			
ROADWAY			
LUNCH			Yes
M			Yes
N			Yes
A			No
AT			No
R			
S			
T			Yes
LAVA			No
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station S

Station Monument: None

Reference Points: None

Target: Missing since 1960

Target Intersection Above Monument:

Description:

A photogrammetric control target established by A. E. Harrison in 1957 on a rock knob above and south of a waterfall between the Roosevelt and Coleman Glacier tongues. The target was lost after the second winter and has not been recovered or replaced.

Tentative Coordinates:

x = 55,293.50 feet	y = 60,670.80 feet	Elevation = 5,432.5 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			Yes
F			Yes
W			Yes
P-3			Yes
P-4			Yes
BEDROCK			
ROADWAY			
LUNCH			Yes
M			Yes
N			Yes
A			No
AT			Yes
R			
S			
T			Yes
LAVA			No
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station T

Station Monument: Aluminum disk, labeled UWCE T

Reference Points: Station L distant 11.38 feet, azimuth 162.275°

Target: Four-foot, oval, white wooden target with black X.

Target Intersection Above Monument: 2.44 feet

Description:

A photogrammetric control point and triangulation point for connecting the EW and MN baselines. It is identified by an aluminum monument, embedded in bedrock at the bottom of a wide crevice. A four-foot, oval, white wooden target, tilted slightly forward, is bolted to bedrock above it. Station T was only 70 feet from advancing ice in September, 1974.

Tentative Coordinates:

x = 52,331.20 feet y = 62,019.74 feet Elevation = 4,618.0 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	57.63833	3,837.48	Yes
F			Yes
W	48.41167	3,551.84	Yes
P-3	288.82444	10,246.14	Yes
P-4	290.68828	8,161.32	Yes
BEDROCK	306.85757	9,062.35	Yes
ROADWAY	304.71296	8,884.95	Trees
LUNCH	353.83563	1,909.83	Yes
M	333.37000	1,846.16	Yes
N	326.12861	1,887.21	Yes
A	177.66417	1,310.95	No
AT	178.42861	1,387.86	No
R			Yes
S			Yes
T			
LAVA	166.27750	2,550.73	No
HELIOTROPE	206.92001	7,740.65	Yes

COLEMAN GLACIER SURVEY

Station LAVA

Station Monument: Aluminum disk, labeled UWCE G

Reference Points: None

Target: Missing since 1963

Target Intersection Above Monument:

Description:

This point was described by Kermit Bengtson in 1949 as a prominent lava knob just above the treeline, between Stations A and D. It was also known as Monument Rock by the Seattle Mountaineers about fifty years ago. It was established as a temporary control point for terrestrial photogrammetry by Kermit Bengtson in 1954. It is now identified by an aluminum monument embedded in the top of the lava knob at a new location.

Tentative Coordinates:

x = 52,936.28 feet	y = 59,541.82 feet	Elevation = 5,359.1 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	30.18806	5,243.02	Yes
F			Yes
W	22.98889	5,252.71	Yes
P-3	299.30917	11,815.69	Yes
P-4	303.04877	9,830.67	Yes
BEDROCK	315.20942	11,151.08	Yes
ROADWAY	313.62390	10,925.28	Yes
LUNCH	349.51285	4,451.06	Yes
M	340.86222	4,369.74	No
N	337.72472	4,371.05	No
A	334.71972	1,291.78	No
AT	332.52889	1,229.18	No
R			No
S			No
T	346.27750	2,550.73	No
LAVA			
HELIOTROPE	222.89056	6,038.24	Yes

COLEMAN GLACIER SURVEY

Station HELIOTROPE

Station Monument: Aluminum disk, labeled UWCE H

Reference Points: Nail in concrete, six feet back in line with E

Target: Rock cairn and 8 inch aluminum with orange and black X

Target Intersection Above Monument:

Description:

This point was originally a rock cairn about three feet high on the peak of Heliotrope Ridge and was identified by the United States Geological Survey as 47-76B. The cairn was raised about two feet in 1957 to make it more visible from Bastile Ridge, and this change moved its position about one foot east of its original position. The point is now identified by an aluminum monument embedded in concrete poured into the loose rocks. The position has been moved closer to the edge of the cliff to improve visibility and allow the station to be occupied with a theodolite.

Tentative Coordinates:

x = 48,826.65 feet	y = 55,117.87 feet	Elevation = 7,128 feet	
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E	36.98878	11,212.37	Yes
F			Yes
W	33.63905	11,121.92	Yes
P-3	328.75337	11,939.97	Yes
P-4	337.11441	10,621.20	Yes
BEDROCK	343.10844	12,894.01	Yes
ROADWAY	342.38004	12,550.34	Trees
LUNCH	20.55161	9,398.84	Yes
M	17.38143	8,961.39	Yes
N	16.15217	8,816.83	Yes
A	32.46702	6,627.96	No
AT	32.71725	6,554.40	No
R			
S			
T	26.92001	7,740.65	Yes
LAVA	42.89056	6,038.24	Yes
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station B

Station Monument: Bronze disk, labeled 2B-49

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A control point established by Kermit Bengtson in 1949 for measuring the position of the Coleman Glacier terminus. It is a bronze monument, similar to the USGS monuments, embedded in bedrock near the east edge of the "Bench." It was covered by advancing ice in 1952 or 1953.

Tentative Coordinates:

x = 52,402 feet	y = 61,562 feet	Elevation = 4,693 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station B-1

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A photogrammetric control point established by Kermit Bengtson in 1954 on the summit of the Black Butte named Colfax Peak. This point has not been used or permanently identified.

Tentative Coordinates:

x = feet	y = feet	Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station B-2

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A photogrammetric control point established by Kermit Bengtson in 1954 on a sharp point on the west slope of the Black Butte named Lincoln Peak. This point has not been used or permanently identified.

Tentative Coordinates:

x = feet y = feet Elevation = feet			
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station C

Station Monument: Bronze disk, labeled 3B-49

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A control point established by Kermit Bengtson in 1949 for measuring the position of the Coleman Glacier terminus. It is a bronze monument, similar to the USGS monuments, embedded in bedrock on a morainal hillock on the "Bench". It was never relocated and it is not known when it was covered by the advancing ice.

Tentative Coordinates:

x = 52,252 feet	y = 61,340 feet	Elevation = 4,700 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station C'

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A control point near the edge of a small cliff on the "Bench", established by Kermit Bengtson in 1949 for measuring the position of the Coleman Glacier terminus. This point was identified by a half-inch hole about one-half inch deep in bedrock. It was covered by advancing ice during the winter of 1953-54.

Tentative Coordinates:

x = 52,318 feet	y = 61,577 feet	Elevation = 4,698 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station D

Station Monument: Bronze disk, labeled 4B-49

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A control point established in 1949 by Kermit Bengtson for locating a higher profile station. It is a bronze monument, similar to the USGS monuments, embedded in bedrock 150 feet west of the main stream of ice in 1949. It was used to locate a temporary profile station closer to the ice. The temporary station was covered by the advancing Heliotrope Glacier in 1954 and Station D was covered by ice in 1955.

Tentative Coordinates:

x = feet y = feet Elevation = 6,050 feet			
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station D'

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A control point established in 1949 by Kermit Bengtson for measuring the position of the Coleman Glacier. It was an orange cross painted on bedrock at the edge of the cliff on the east side of the "Bench". It was covered by ice in 1952 or 1953.

Tentative Coordinates:

x = 52,512 feet	y = 61,566 feet	Elevation = 4,683 feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station J

Station Monument: One-inch brass disk, labeled J

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

Stations J, K and L were established on the Bench in 1953 by A. E. Harrison to supplement the points installed by Kermit Bengtson in 1949. Station J is a one-inch brass monument embedded at the east end of a bedrock ridge. This point was covered by outwash from the glacier in 1956. The ice covered the point in 1957 and withdrew in 1958. The ice terminus on the Bench was about 28 feet from Station J in 1964. The point has been covered and exposed several times between 1964 and 1968. The point was covered by ice in 1974.

Tentative Coordinates:

x = 52,342 feet	y = 61,828 feet	Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station K

Station Monument: One-inch disk, labeled K

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

Station K is a one-inch brass monument embedded in bedrock on the Bench near the edge of the cliff by A. E. Harrison in 1953. (See description of Station J.) This point was used principally as a photographic station until it became too close to the ice in 1955.

Tentative Coordinates:

x = 52,411 feet	y = 61,954 feet	Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			Yes
F			Yes
W			Yes
P-3			
P-4			No
BEDROCK			No
ROADWAY			No
LUNCH			No
M			No
N			No
A			No
AT			No
R			
S			
T			Yes
LAVA			No
HELIOTROPE			No

COLEMAN GLACIER SURVEY

Station L

Station Monument: One-inch brass disk, labeled L

Reference Points: Station T, distant 11.38 feet, azimuth 342.25%

Target: None now

Target Intersection Above Monument:

Description:

This station is on bedrock near the top of a small morainal knoll on the Bench. (See description of Station J.) It is a one-inch brass monument. The monument installed by A. E. Harrison with concrete in 1953 was re-installed with epoxy cement in 1965. The station proved unsatisfactory as a control point and was replaced by Station T, 11.38 feet closer to the edge of the Bench and visible from both the M-N and E-W baselines. Station L is now used principally as a photo point on the Bench.

Tentative Coordinates:

x = 52,334.67 feet	y = 62,008.90 feet	Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			Yes
F			Yes
W			Yes
P-3			Yes
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			No
N			No
A			No
AT			No
R			Yes
S			
T	342.25000	11.38	Yes
LAVA			No
HELIOTROPE			Yes

COLEMAN GLACIER SURVEY

Station P-1

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A photographic station established July 29, 1952 by A. E. Harrison. Its location has not been constant or clearly defined. Changes in grading of the road have altered the space available for parking and the photo position has moved about fifty feet closer to the mountain. It became evident in 1956 that the point had been poorly chosen, as the terminus of the Coleman Glacier had advanced out of sight behind some trees.

Tentative Coordinates:

x = feet	y = feet	Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			No
N			No
A			No
AT			No
R			
S			
T			Yes
LAVA			Yes
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station P-2

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A photographic station established July 29, 1952 by A. E. Harrison. Its location, like that of Station P-1, has been variable, although most photographs have been taken from a particular stump about 250 feet up the road from the bend shown on the map. This station is now used primarily in the winter when it is not convenient to occupy stations P-4 and P-3.

Tentative Coordinates:

x = feet	y = feet	Elevation = feet

To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			No
N			
A			No
AT			No
R			
S			
T			Yes
LAVA			Yes
HELIOTROPE			Yes

COLEMAN GLACIER SURVEY

Abandoned Railroad Grade

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A photographic station was established in 1962 at the abandoned railroad grade on the south side of the Mt. Baker highway, east of the old grade crossing and west of the Highway Rest Area at Boulder Creek. Although much further from Skyline Ridge than the highway bridge at Glacier, Washington, it has the advantage that Bastile Ridge is also visible. The station has not been occupied since 1970 because trees have blocked the view.

Tentative Coordinates:

x = feet y = feet Elevation = feet			
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			No
F			No
W			No
P-3			No
P-4			No
BEDROCK			No
ROADWAY			No
LUNCH			No
M			No
N			No
A			No
AT			No
R			No
S			No
T			No
LAVA			No
HELIOTROPE			No

COLEMAN GLACIER SURVEY

Highway Bridge at Glacier

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A photographic station was established by A. E. Harrison in 1959 on the south side of the west approach to the highway bridge crossing Glacier Creek, the second bridge between the town of Glacier and the Forest Service Ranger Station. The point is used for photographs showing the extent of snow on Skyline Ridge and Chowder Ridge during the melting season.

Tentative Coordinates:

x = feet y = feet Elevation = feet			
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			No
F			No
W			No
P-3			No
P-4			No
BEDROCK			No
ROADWAY			No
LUNCH			No
M			No
N			No
A			No
AT			No
R			No
S			No
T			No
LAVA			No
HELIOTROPE			No

COLEMAN GLACIER SURVEY

Bastile Meadow

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

The lower meadow on Bastile Ridge is an excellent campsite. A table and a few dishes are left at the site. Water is available and trees give some protection. The United States Geological Survey station 47-76A was located in a swampy area near the upper, northeast end of the meadow. A second, larger meadow is situated above the EW baseline but has no water source and is less protected.

Tentative Coordinates:

x = feet y = feet Elevation = feet			
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			No
F			No
W			No
P-3			Yes
P-4			No
BEDROCK			No
ROADWAY			No
LUNCH			No
M			No
N			No
A			No
AT			No
R			No
S			No
T			No
LAVA			No
HELIOTROPE			No

COLEMAN GLACIER SURVEY

Station DOBBS 1892

Station Monument: None

Reference Points: Cairn in 1974

Target: None

Target Intersection Above Monument:

Description:

A photo point used by Dobbs in the Edson party on July 25, 1892, re-occupied by Pete Erben and Roger Lord on July 25, 1974. Marked by a small cairn slightly west of the saddle west of Peak 7122 on Chowder Ridge.

Tentative Coordinates:

x = feet y = feet Elevation = feet			
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

COLEMAN GLACIER SURVEY

Station Chowder

Station Monument: None

Reference Points: None

Target: None

Target Intersection Above Monument:

Description:

A photo station on Chowder Ridge, slightly east of the highest rock on Peak 7122. Occupied on July 25, 1974, by Roger Lord. Proposed to be marked with a monument and cairn for future use.

Tentative Coordinates:

x = feet y = feet Elevation = feet			
To Station	Assumed Coordinate Azimuth	Distance in Feet	Intervisibility
E			
F			
W			
P-3			
P-4			
BEDROCK			
ROADWAY			
LUNCH			
M			
N			
A			
AT			
R			
S			
T			
LAVA			
HELIOTROPE			

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